EXHIBIT 37

EXPERT REPORT OF THEODORE R. HOLFORD, PhD

This report was prepared at the request of Corey Gordon of Blackwell Burke P.A. to provide an expert report and opinions with respect to epidemiological and biostatistical issues raised in litigation involving the 3M Bair Hugger warming system. The opinions I express herein are opinions I hold to a reasonable degree of scientific certainty and are based upon the references cited and listed herein as well as my background, training, and experience. I reserve the right to amend or add to these opinions if I learn of additional information material to my opinions.

In 1973, I was awarded a Ph.D. in Biometry at Yale University and I was chair of the Biostatistics Department at Yale School of Public Health for fifteen years. I am a fellow of the American Statistical Association and the American College of Epidemiology. In 1981, I received an Eleanor Roosevelt International Cancer Fellowship which was spent at Oxford University. In addition, I have received the Wakeman Award for Research in Neurosciences. I am currently Susan Dwight Bliss Professor of Epidemiology and Public Health (Biostatistics) at the Yale University School of Public Health. I have played a leading role in training both pre-doctoral and post-doctoral students in biostatistics and epidemiology, including assessment of the effects of environmental exposure on disease risk. I co-directed with Dr. Tongzhang Zheng on a Fogarty training program entitled "Cancer Epidemiology and Biostatistics Training in China" which included the conduct of workshops on methods for cancer epidemiology research in China, as well as the mentoring of trainees on their individual research projects.

My research involves the development and application of statistical methods in public health and medicine. This work led to the publication of a text book entitled *Multivariate Methods in Epidemiology.*[1] I am recognized for developing an approach for analyzing temporal trends in disease rates using the age-period-cohort modeling framework that is used extensively in the analysis of cancer incidence and mortality trends. Currently, I am extending and applying these concepts in a population model for lung cancer and other diseases related to cigarette smoking that can be used for evaluating cancer intervention strategies as part of the Cancer Intervention and Surveillance Modeling Network (CISNET). This work has appeared in a variety of scientific journals including the *Journal of the American Medical Association* and *Journal of the National Cancer Institute*. My CV is attached at exhibit A.

This report is a review of the observational study of risk for deep infection following use of Bair Hugger warming device during knee and hip replacement surgery compared to Hot Dog conducted by McGovern et al.[2] This is the only study to my knowledge that has directly compared risk during periods in which each of these devices was used. As part of the depositions of Mr. Mark Albrecht,[3] Dr. Michael Reed,[4] and Dr. Paul McGovern[5] data were provided on the experience at Wansbeck General Hospital, which is part of the Northumbria Healthcare NHS Foundation Trust, that formed the basis for the McGovern study, as well as some time before and after the study (see Albrecht deposition exhibit 10; McGovern deposition exhibit 16) This study was the primary source of a review by Dr. Jonathan Samet[6] which considered this work in drawing a scientific inference on whether there is evidence for inferring a

causal association between risk of deep infection and use of the Bair Hugger warming device during surgery.

In order to consider the question of a causal association, results from the McGovern study were first audited in an attempt to reproduce the results that appear in the McGovern paper.[2] This report then continues with a discussion of the impact that any changes in results might have on inferring an association that can be justified as being causal, as suggested in a report by Samet.[6]

Conclusions from the McGovern study

As part of a bubble study of air flow in an operating room using the Bair Hugger compared to the Hot Dog, McGovern et al. conducted an observational study of infection rates for a retrospectively chosen period when the Bair Hugger device was used for surgeries conducted at Wansbeck General Hospital (7/1/2008 to 3/1/2010). This was compared to a period in which the hospital had switched to Hot Dog use (6/1/2010 to 1/1/2011). Data that included these periods from Wansbeck General Hospital were produced by Dr. Scott Augustine in response to a subpoena (Albrecht deposition exhibit 10) and were discussed as part of depositions from Mr. Mark Albrecht,[3] Dr. Mike Reed[4], and Dr. Paul McGovern,[5] Dr. McGovern also produced a spreadsheet with infection data (McGovern deposition Exhibit 16). These data and the clarifying testimony from these three study authors were used in an attempt to validate results reported by McGovern et al.[2] and reviewed in the report by Samet.[6]

Infection proportions by selected warmer use

Analysis of the data file (Albrecht Ex. 10) using SAS 9.4® shows 4/372=1.08% infections during Hot Dog use and 31/1065=2.91% during Bair Hugger use. Chi-square works well for comparing proportions when the sample size is large, but Fisher's exact test gives an accurate P-value whether the sample size is large or small.[7] For these data, the sample size is small, so Fisher's exact test is most appropriate, giving two-sided P=.0507 which is not statistically significant in that it is greater than .05. McGovern et al.[2] use the chi-square test, which for this tabulation is X^2=3.9089, df=1, P=.0480 which is just below the conventional limits to be considered statistically significant (0.05). The difference between these two significance tests is not great in magnitude, but the conclusions change from not significant to being significant, the former being the more accurate test.

The odds ratio for this comparison is 2.76 and the 95% exact confidence limit is 0.97-10.82, which is wide and inclusive of the null value of 1. The wide confidence interval, in this case the range is ten-fold, demonstrates that the estimated association is not precise and it actually includes the null value of 1. This does not by itself necessarily suggest bias, but instead the lack of precision that has resulted from a study of this size. Reliance on a single observational study, especially when the confidence interval is so wide and includes the null value of 1, to reach a conclusion that a causal relationship has been demonstrated is not justified scientifically.

Results from the paper by McGovern et al.[2] are incorrectly given as 3/371=0.81% for Hot Dog and 32/1066=3.00% for Bair Hugger. Using this tabulation, Fisher's exact test gives P=.0176, although chi-square is used in the paper, X^2=5.5529, df=1, P=.0185. The odds ratio is larger, 3.79 with an exact confidence interval of 1.15 to 12.45, which is also wide but it does not include the null value. Wide confidence limits reflect the lack of precision for the estimate of the odds ratio, and it is a result of the relatively small sample size in the McGovern study. The results reported by McGovern are incorrect,

however, because they arise from an incorrect tabulation, an error is recognized in the depositions by Albrecht,[3] Reed[4] and McGovern .[5]

The testimony of Dr. Reed and Mr. Albrecht demonstrates that the infection rates that appear in the published McGovern analysis were in error.[3,4] Dr. Reed testified that there was one more infection in each group, and Mr. Albrecht testified that the published data differed "slightly" from the newer dataset he had been provided. (Mr. Albrecht had recalculated an odds ratio of 2.98 based on the updated data). Further insight into the errors in data tabulation can be gleaned from the spreadsheet produced by Dr. McGovern (Exhibit 16), which lists the dates and types of procedures that resulted in infections. Of significance, the data on the McGovern spread sheet include infection data from several months prior to the start of the Bair Hugger-only period, as is the case with Albrecht Exhibit 10. All details of the infections in these earlier data on the McGovern spreadsheet correspond exactly with the data on Albrecht Exhibit 10, giving verification that the data in Albrecht Exhibit 10 were the same data upon which the published study was based. Albrecht Exhibit 10, however, provides data for a few additional months past December 2010, the end of the Hot Dog only period in the published McGovern study. The McGovern spreadsheet stops at the end of December 2010, providing further support that the data on this spreadsheet were the data used in preparing the published paper. In examining the McGovern spreadsheet, it is noted that dates at the beginning of the spreadsheet are expressed in the format customary in the U.K. (day/month/year) while dates at the end of the spread are noted in the customary U.S. manner (month/day/year). The McGovern spreadsheet, unlike the full dataset, has a column indicating whether FAW (Bair Hugger) or CFW (Hot Dog) was used. For one entry on the McGovern spreadsheet, Sept. 15, 2010, the warming device is coded as FAW, meaning Bair Hugger. However, the hospital had fully transitioned to Hot Dog by the end of May, 2010, and Dr. McGovern could not explain why there would have been a surgery conducted three and ½ months after the transition using a Bair Hugger. The only plausible explanation consistent with the published information about when each warming unit was being used, as well as Dr. Reed's testimony about the errors in the published data and Mr. Albrecht's acknowledgement that there were "slight" data errors (that resulted in a lower odds ratio), is that, in coding the type of warming device used on the McGovern spreadsheet, someone erroneously categorized the Sept. 15, 2010 surgery as having used a Bair Hugger instead of a Hot Dog. If the Sept. 15, 2010 procedure is counted as a Hot Dog procedure rather than a Bair Hugger procedure, the McGovern spreadsheet then perfectly matches the data on Albrecht Exhibit 10 and explains the errors noted by Dr. Reed and Mr. Albrecht.

Hence, one infection that McGovern tabulated among the Bair Hugger infections should have been counted within the Hot Dog period. The tabulation based on this correct information is shown in the first paragraph of this section.[1]

Infection rate comparison among hospitals

Figure 1 provides a summary of the distribution of infection rates following hip or knee surgery for reporting institutions in the National Health Service that used the Bair Hugger from 2010 to 2015 (based on data from NHS trust tables reporting the experience of infections from hip and knee surgery at trust hospitals.[8] Identification of trusts using Bair Hugger was provided by 3M). No infections were reported

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[1] Even if one assumes that Dr. Reed's recollection in his deposition was correct (that there was one additional infection in each group), the odds ratio is nevertheless markedly different than reported in the published paper: 33/1066 = 3.1% for the Bair Hugger period, 4/37 = 1.08% for the Hot Dog period; OR = 2.86, CI 1.03-8.33, P = .0356

in 36/128=28% of the hospitals. As we have noted above, Wansbeck General Hospital had an infection rate of 31/1065=2.91% during the period used to characterize the experience under Bair Hugger, shown by a red "X" in Figure 1, compared to 444/73,947=0.60% among NHS Trusts using the Bair Hugger from 2010 to 2015. Thus, one would expect to see just 6.39 infections at Wansbeck General Hospital during the period selected by the authors for the Bair Hugger only cohort, but 31 were observed. The significance of this difference yields X^2=95.25, df=1, P<.00001. Clearly, the rate of infection at Wansbeck General Hospital during this period was far higher than the normal experience among other hospitals in the National Health Service, indicating that the infection rate at Wansbeck General Hospital was not in control during this period. Reed describes aggressive measures undertaken during this period by the Northumbria Heathcare Foundation Trust, which includes Wansbeck General Hospital, to control orthopedic surgery infection.[9] Gillson and Lowdon,[10] also discuss the fact that infection rates were indeed out of control at Northumbria Healthcare NHS Trust, which includes Wansbeck General Hospital, during this period and they describe multiple efforts that were introduced in order to bring the infection rate in line with what would normally be expected. The heating device was not the only factor being changed during this time.

The impact of other infection control practices on the infection rate during this time period is addressed by other experts retained by counsel for 3M and is beyond the scope of my opinion. I note, however, that the various infection control practices implemented in an effort to rein in a serious infection problem that had gotten out of control should have been considered, individually and collectively, in assessing the impact of the method of patient warming on infections rates, and the failure to do so injects bias into any univariate comparison of two different warming methods used during this period of time, bias that cannot be corrected for through statistical methods now.

Time trend in infection rates at Wansbeck General Hospital

Time trend of the infection rates were estimated using a 60-day window around each day from 9/1/2007 to 1/1/2011, and they are displayed by the solid blue line in Figure 2. The rates are approximately 1% after 6/1/2010 and somewhat lower before the start of the McGovern study in 7/1/2008, a time when Bair Hugger was being used but before the start of the period that McGovern et al. selected for the period of Bair Hugger-only use. Figure 7 as published in McGovern et al.[2] shows a constant infection rate which is the assumption on which their significance test is based. (In an earlier draft of this manuscript, Figure 7 shows considerable variability in the infection rate during the Bair Hugger period [McGovern Deposition Exhibit 7A, p.2218]. This was not shown in the published version which instead suggests that the rate was constant during this period.) Our estimate that uses the correct tabulation of the data on the overall rates during the study periods is shown by the green line in our Figure 2. The estimated trend is clearly very different from the trend which forms the basis of the significance test shown for the Bair Hugger vs. Hot Dog comparison.

In order to assess whether the variability in trend is just a chance occurrence, the Bair Hugger period used by McGovern et al.[2] was divided into quarters beginning 7/1/2008, which is shown by the broken blue line in Figure 2. The last quarter ends on 3/1/2010, the last day for this treatment period. A chi-square test for equality of infection rates by quarter during the Bair Hugger period yields X^2=15.50, df=6, P=.0167. Thus, there is strong evidence that the rates were highly variable during this time, and Figure 2 suggests that there were actually two separate outbreaks of infection, the second near the end of the Bair Hugger-only period being especially severe. The two months at the start of 2010 had 9/107=8.41% infections following surgery, 14 times the rate seen on average by National Health Service hospitals.

Variability like this strongly indicates a period in which infections were not well controlled, which once again supports the rationale for the aggressive interventions which are described by Reed[9] and by Gillson and Lowdon.[10]

Selection of start date for study

Reasons that McGovern et al. started the Bair Hugger period on 7/1/2008 are not clear. Bair Hugger was standard practice at Wansbeck General Hospital, and one could well justify starting even earlier in order to increase the sample size for the study and thus improve the power. If one were to start follow-up on 10/1/2007, for which data were available and included in the complete dataset (McGovern Exhibit 16), the difference in infection rates is not close to being significant, P=.2179 using Fisher's exact test, with an odds ratio of 2.12 (95% confidence interval of 0.75-6.00). If the infection rates were indeed constant, one would expect the P-value to become even smaller because of the increase in the sample size due to the increase in the number of operations during the extended duration. However, Figure 2 shows that the rate is actually much lower during this time period when the rates were under control and close to the experience seen at other hospitals in the National Health Service.

McGovern et al.[10] employed the chi-square test as the test of significance. In Figure 3 we show chi-square using alternative months for starting the Bair Hugger period, beginning 10/1/2007. We see that the chi-square statistic increases with time, finally crossing the value of 3.84, the critical value for statistical significance at P=.05, on 7/1/2008, the date used by McGovern et al.[2] to start the study period, showing statistical significance at the 5% level using the chi-square test. The starting point for the Bair Hugger-only period used in the McGovern et al. analysis coincided with a time when the infection rate was beginning to increase as infection control was being lost at Wansbeck General Hospital. Results reported by McGovern are a function of the lack of infection control during this period. Had the Bair Hugger-only study period been chosen to start even one month earlier, the results would not have not reached statistical significance.

Comparison of the effect of thromboprophylaxis regimen on study results

Jensen et al.[11] conducted a study of the use of rivaroxaban, which was introduced into the Wansbeck General Hospital surgery for knee and hip replacement from 8/1/2009 to 2/28/2010. These were compared to the rates when tinzaparin was used from 2/1/2009 to 7/31/2009. The entire Jensen study period took place within the Bair Hugger period used by McGovern et al.[2] and this was also the period that Wansbeck General Hospital was experiencing considerable variability and high rates of infection. Two important differences between the McGovern et al. and the Jensen et al. studies are: (a) McGovern limited recruitment to non-trauma cases while Jensen did not, which yielded more operations in both arms of the Jensen study; and, (b) Jensen reported infections diagnosed within 30 days of surgery while McGovern used a 60 day limit.

Jensen et al.[11] report 5/489=1.02% infections for the tinzaparin cases and 14/559=2.50% for rivaroxaban, Fisher's exact P=.1026, OR=2.49, 95% CI=0.89-6.95, which is not statistically significant. However, if one adopts the same inclusion and outcome criteria used by McGovern[2] then the results are 3/307=0.98% for tinzaparin and 18/400=4.5% for rivaroxaban, Fisher's exact P=.0064, OR=4.77, 95% CI=1.37-25.49. The latter results are more relevant for the question of whether use of this medication was an important confounder for the McGovern study because it is specifically applied to the same type of patient with a comparable definition of the outcome. Hence, these data do strongly point to rivaroxaban use to be an important confounding variable because it is associated both with the

outcome, deep infection, and type of warmer used, i.e., rivaroxaban was *only* used during the Bair Hugger period.

A potential confounding factor, like rivaroxaban or tinzaparin use, should be controlled in the analysis in order to obtain valid estimates for the comparison of Bair Hugger and Hot Dog. Controlling for type of thromboprophylactic in this case can be done by using only the Bair Hugger period when tinzaparin is used, the thromboprophylactic shared by patients in both groups (7/1/08 to 7/31/09). In this case, the results are 4/372=1.08% for Hot Dog and 22/958=2.30% for Bair Hugger, with Fisher's exact P=.1874, OR=2.16, 95% CI=0.73-8.69. These results do not support a conclusion that there is a strong association of infection risk with Bair Hugger use as they are well within what might have expected by chance alone.

In my analysis here, only a single potential confounding variable has been controlled. Clearly, other changes described by Dr. Reed as well as Gillson and Lowdon[10] could also have an effect. If anything, it is likely that they would have attenuated the estimated association still further.

Comparison of the effect of antibiotic regimen on study results

On March 1, 2009 the antibiotic regimen used at Wansbeck General Hospital was changed from Gentamicin 4.5 mg/kg to Gentamicin 3 mg/kg and Teicoplanin 400 mg. During the period when Bair Hugger was used with Gentamicin 4.5 mg/kg, 13/676=1.92% was the rate of infection and when Gentamicin 3 mg/kg and Teicoplanin was used, the rate was 21/670=3.13%. The difference is not statistically significant, P=0.1683.

In order to control for both thromboprophylactic and antibiotic, one must use the Bair Hugger period that shares the same antibiotic and thromboprophylaxis regimen used during the Hot Dog period, i.e., March 1, 2009 to July 31, 2009, which had an infection rate of 3/270 = 1.11% compared to 4/372 = 1.08% during the Hot Dog period, P=1.000. As McGovern et al. co-author and statistician Mark Albrecht[3] conceded in his deposition, once the antibiotics and thromboprophylaxis regimen are controlled for, there is no difference in infection rates between Bair Hugger and Hot Dog. In this case, all of the difference in risk is accounted for by these two confounding variables.

Conclusions regarding the McGovern et al. findings

My analysis of the data used in the McGovern et al.[2] study indicates that they do not support a conclusion that risk of deep infection is greater when Bair Hugger is used compared to Hot Dog. Reasons why the McGovern et al. conclusions are not valid are:

1. The tabulation provided by McGovern is not accurate because one of the cases in the Hot Dog group was incorrectly switched to the Bair Hugger group. In addition, numbers are small, so that the Fisher's exact test would be preferred over the chi-square test which uses an approximation. Correcting these errors yields a P-value greater than .05, which is close but not statistically significant.
2. The period attributed to Bair Hugger use shows that the infection rate at Wansbeck General Hospital was out of control, as can be seen by:
    a. The rate of deep infection was far higher than other hospitals in the National Health Service, P<.00001;
    b. The infection rate varied considerably during the Bair Hugger period, the experience that one would expect when conditions were not being well controlled;

c. Results are very sensitive to the start date, an effect that is caused by the infection control difficulty being experienced by Wansbeck General Hospital during the Bair Hugger period; and,
d. Many different control measures were being implemented at Wansbeck General Hospital during the time these surgeries were being performed. There is very strong evidence that the thromboprophylactic being used was in and of itself strongly associated with the infection rate in these patients and it was only used during the Bair Hugger period.

3. Controlling for potential confounding variables is always a serious concern in observational studies, especially when two time periods are being compared. Inevitably, more than one factor will change with time. In these data, there is strong evidence of an association with infection risk from at least one such variable: thromboprophylaxis. Controlling for just this one confounding variable largely explains the difference between the infection rates for Bair Hugger and Hot Dog use. If one also controls for the antibiotic regimen, the infection rates are virtually identical.

Causation findings.

Assessment of factors thought to be possible risk factors for disease can be a challenge to unambiguously identify. This can best be accomplished by conducting a well-designed experiment in which only the factor of interest is changed while all other potential risk factors have been held constant. The identification of cigarette smoking as a major, if not **the** major risk factor for lung cancer has been one of the greatest successes in public health during the twentieth century, and as Professor Samet correctly points out, this was done through careful analysis of observational studies that did not include designed experiments such as randomized controlled clinical trials. However, there were multiple studies directly addressing health effects that yielded consistent results so that taken together, they provided overwhelming evidence that there was a harmful effect on human health and that effect was substantial. The robust and consistent data from multiple studies provided a way forward for launching policies that would reduce what had become a catastrophe.

Professor Samet likens our knowledge of the underlying science on risk of deep infection affected by the Bair Hugger and Hot Dog surgical warming devices to cigarette smoking and lung cancer. The beginning of a broad consensus in the public health community around the adverse effect of cigarette smoking and health risk is well summarized in the first Surgeon General's Report on smoking and health which appeared in 1964.[12] On lung cancer alone, this report included results from 29 retrospective studies, all but one of which found excess risk among cigarette smokers (p.27), and 7 prospective studies (involving more than 1 million people in three different countries) The estimated associations were far stronger than what is found for the Bair Hugger and Hot Dog comparison. In Table 4 on p.161, for example, relative risks for smokers of more than 1 pack/day or heavy smokers had relative risks that range from 10.8 to 34.1.[12] The evidence regarding the harmful effect of cigarette smoking has grown enormously since 1964.[13] For the Bair Hugger v Hot Dog comparison we have but one study with a point estimate of 2.76 that is not statistically significant and largely explained by confounding variables. There is no similarity between the current state of the science related to the Bair Hugger and the evidence on cigarettes even 50 years ago. Reliance on a single, flawed study to infer a causal relationship is not consistent with valid scientific methodology in general, and it does not compare with the methodology that resulted in the conclusion that cigarette smoking causes lung cancer.

However, the logic for causal inference drawn from observational epidemiologic research is relevant for trying to understand the evidence on warming devices. To draw scientific conclusions on the state of existing evidence, it is useful to consider criteria for determining causality like those suggested by Samet:[6]

1. Temporality
2. Strength of association
3. Consistency
4. Coherence

In the discussion below, these criteria are reviewed while taking into account the new analyses of the data from which the McGovern study were drawn.[2]

Temporality

Samet points out that temporality must hold if a factor of interest is a cause for a particular disease. This is obviously satisfied for exposure to Bair Hugger and Hot Dog. It is also satisfied for tinzaparin and rivaroxaban as a potential confounding factor under consideration, as well as other infection control practices implemented prior to the switch to Hot Dog.

Strength of association

The point estimate for the association between Bair Hugger and Hot Dog referred to by Samet is 3.8, which is reported by McGovern et al.[2] This estimate of effect is not actually supported by a corrected analysis of the data because:

1. One subject said to be in the Bair Hugger group was actually in the Hot Dog group. Correcting this tabulation changes the test for significance from statistically significant to not statistically significant. The correct estimate for the odds ratio is 2.76 and the 95% CI= 0.97-10.82. The confidence interval is wide and actually includes the null value of 1. Hence, it is not a strong indication of an adverse health effect.
2. The period used to represent the experience for the Bair Hugger exposure was one in which infections were out of control at this hospital. This is indicated by:
    a. Significantly higher rate of infection compared to other hospitals in the National Health Service that also used the Bair Hugger device.
    b. Strong evidence of instability and temporal variability in the incidence rate during the period used.
    c. Sensitivity to the start date used, which coincided with what can be seen to be the start of the time when control of infections was being lost at Wansbeck General Hospital.
3. Not even a single potential confounding variable was included in any of the analyses. Samet argues that this would be unlikely to affect the conclusions because of the magnitude of the estimated association. However, he shows no data to support this view. This conclusion, in fact, is not scientifically valid because:
    a. The estimate of the association is actually considerably smaller than what is cited, 2.8 and not 3.8 when one uses the correctly tabulated data.
    b. Use of rivaroxaban was dismissed as a potential confounding variable based on the lack of statistical significance reported by Jensen et al.[11] However, Breslow and Day[14] show that statistical significance is not essential for a factor to confound an estimated

association and a factor can be a confounder even if the association is not statistically significant. In order for a factor to be a confounder it must be associated both with treatment exposure and with the outcome. Rivaroxaban was only used during the Bair Hugger period, so it is clearly associated with treatment. While Jensen et al.[11] did not find a significant effect for rivaroxaban, the study used different criteria than that used by McGovern et al. A reanalysis using data that are consistent with the criteria used by McGovern et al.[2] do show quite strong and statistically significant evidence that it is associated with risk of deep infection in this group of non-trauma patients. More importantly, after controlling for rivaroxaban use the Bair Hugger/Hot Dog result is not close to statistical significance (P=.1874), establishing that thromboprophylaxis is in fact a confounding factor.

c. The period of time being used as representative of the broad experience seen for Bair Hugger use clearly shows a much higher rate of infection than normal experience. In addition, there is strong evidence of fluctuation during this period, which is what is commonly seen when a surgical facility is having difficulty controlling infection.

d. Because Wansbeck General Hospital was experiencing a problem controlling infection, aggressive action was taking place in an attempt to bring it into control, as described by Reed,[9] as well as Gillson and Lowdon.[10] These activities were intended to drive down the infection rates, and the data indicate that this was largely accomplished by the time that Hot Dog use began at Wansbeck General Hospital.

Consistency

The only epidemiological study considered by Samet is McGovern et al.[2] In fact, there is no consistent evidence of a harmful effect of Bair Hugger use because no other study is currently available. This is in sharp contrast to the evidence linking cigarette smoking and cancer.

Instead, Samet describes some consistency among studies in which the outcome is the distribution of particles in experimental conditions in studies conducted by investigators employed and/or supported by a competitor of Bair Hugger. Particles are at most an intermediate outcome that has not been shown to directly relate to the outcome of interest, deep infection. Repeated efforts by this group of investigators failed to show that Bair Hugger increased spread of the number of bacteria that cause deep infection, as described by Albrecht,[3] McGovern[5] and Legg.[15] The unpublished results of these unsuccessful efforts to link Bair Hugger use with an increase in bacterial burden are also alluded to in published papers by this group.[16,17] The field of microbiology is beyond my area of expertise, so I leave it to others to discuss this evidence further. However, no direct scientific evidence of a causal link supporting the hypothesis that Bair Hugger use is associated with an increased risk of deep infection is provided, other than McGovern et al.[2]; thus, there is no consistency.

Coherence

The concept of coherence across the various lines of evidence currently available on deep infection risk for Bair Hugger compared to Hot Dog does not hold, as proposed by Samet. The breakdown in the coherence arises because:

1. There is only one very flawed epidemiological study reporting an association. The work above documents not only the problems in the way that the McGovern et al. study was conducted, but also in the analysis that (a) used an incorrect tabulation of data; (b) a period of time when the

infection rate for the hospital was out of control and not representative of the broad experience with using the Bair Hugger; and, (c) failure to control for confounding variables that can account for the reported results.

2. The studies reported to be consistent dealt with particles in general, not bacteria shown to cause deep infection. Studies that examined the impact of Bair Hugger use show an effect on particle distribution,[18,19] but not viable particles, i.e., bacteria, as described by Albrecht.[3] Hence, the relevance of these particle studies to the scientific question of interest is lacking.

Conclusion

The current state of knowledge regarding a causal association of deep infection risk with use of Bair Hugger compared to Hot Dog is not supported by the underlying science. A single, limited, and flawed observational study cannot provide the rigorous scientific evidence needed to show a causal effect. A single observational experience inevitably has many potential factor changes, some of which are measured and some are not. Arbitrarily picking two periods of time to compare are particularly problematic, because one or more factors are being changed and balance between the groups has not occurred.

This analysis has shown that the data used by McGovern et al.[2] do not show an association with risk when the tabulated results have been corrected and a confounding factor has been appropriately controlled. In addition, the comparison period used to represent the experience under Bair Hugger is one in which the infections at Wansbeck General Hospital were not being well controlled and thus not a good representation of the experience in the National Health Service.

A copy of my CV, including list of publications, is attached hereto. Materials I reviewed and considered in preparing this report are referenced herein and included in the list of references. I am being compensated at the rate of $500.00 per hour for my work on this matter. I have not testified as an expert in any other matter in the previous four years.

6/1/2017
Date

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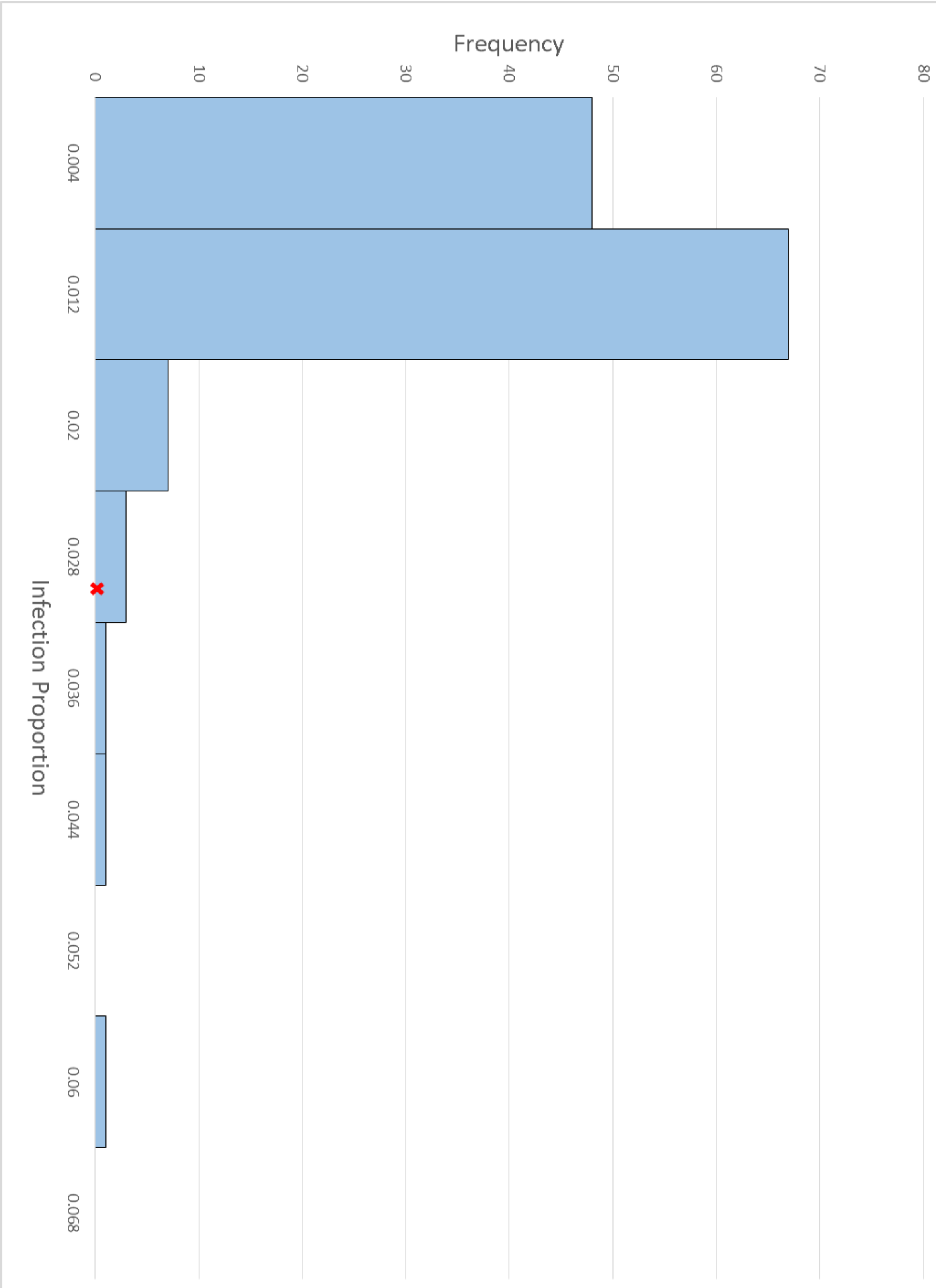

Figure 1. Distribution of hospital infection rates for National Health Service hospitals, 2010-2015.

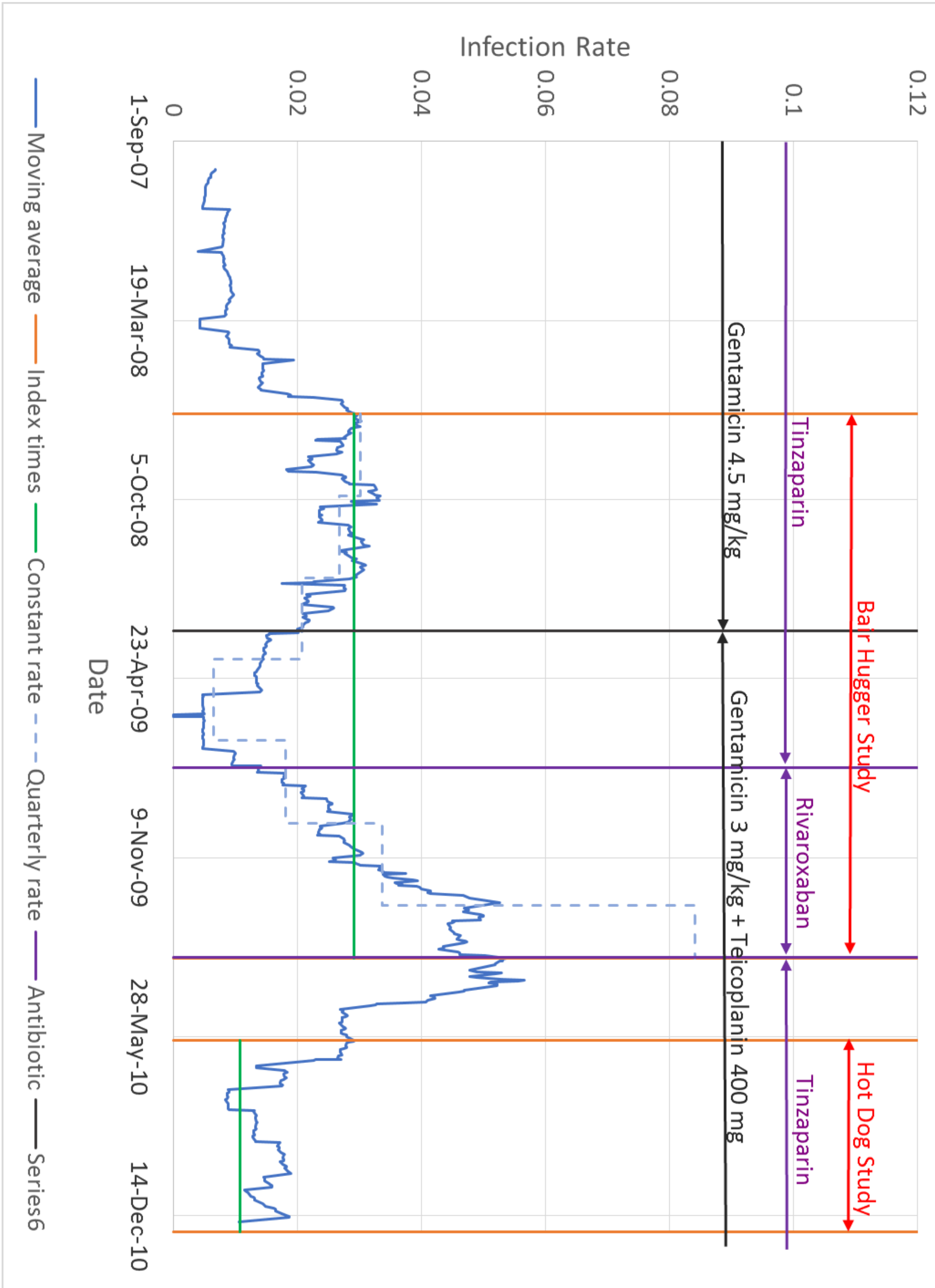

Figure 2. Time trend for infection rates and events: 60-day moving average (solid blue), quartile rates during Bair Hugger use (broken blue), constant rate (solid green), McGovern Study periods (solid orange), thromboprophylaxis used (purple), antibiotic used (black).

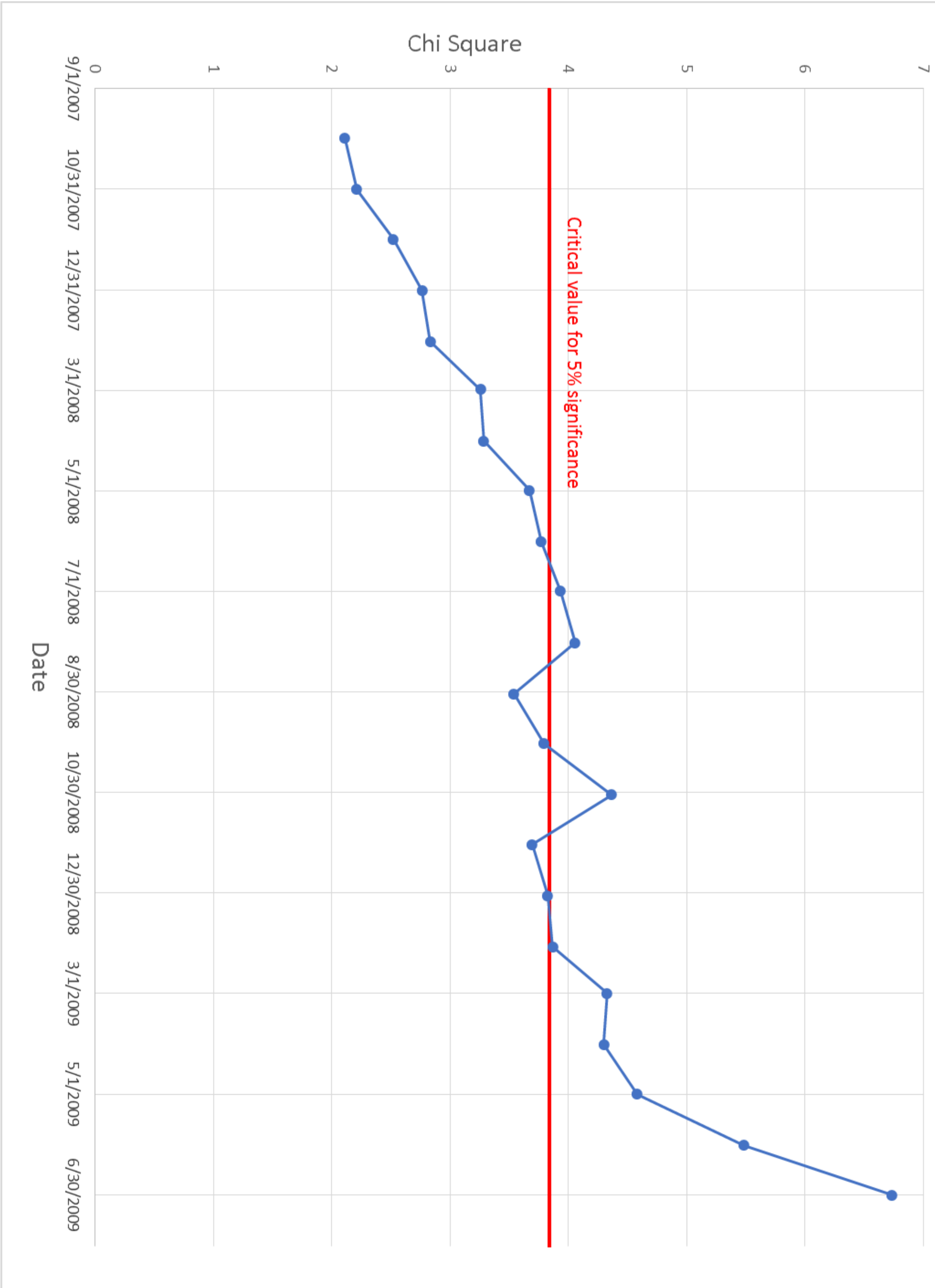

Figure 3. Trend in chi-square with date of start of study.

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